Work Function Measurements in Kelvin Force Microscopy: Analytical Understandings of Experimental Parameters Effects

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ABSTRACT

The importance of the experimental protocol optimisation of the sample surface preparation in Kelvin Force Microscopy (KFM) has already been emphasized [1, 2]. We extrapolate these works by investigating the influence of the most relevant experimental parameters on the Work Function (WF) difference measurements obtained using KFM technique operating in both a nitrogen and ambient environment. Effects of the separation distance between the tip and the sample (Lift height), the ac bias potential applied to the tip (V_{ac}) and the environment relative humidity (R.H.%) were investigated. Measurements were done, in the same conditions, on various metallic samples (Au, Ru, Cu, Pt, Al). Similar trends of the WF difference variations as a function of the lift height changes were observed for all samples (figure 1). A thorough understanding of these effects is of great importance to interpret the quantitative measurements made by KFM. Using the method of images, we developed an analytical model, based on the interpretation of surface patches charge distribution issued from the WF anisotropy over the sample surface [3,4]. Figure 1 shows the agreement between the analytical model (lines) and experimental results (points) obtained on all metallic samples cited above. In conclusion, we propose a mechanism for the observed WF dependence on experimental parameters.

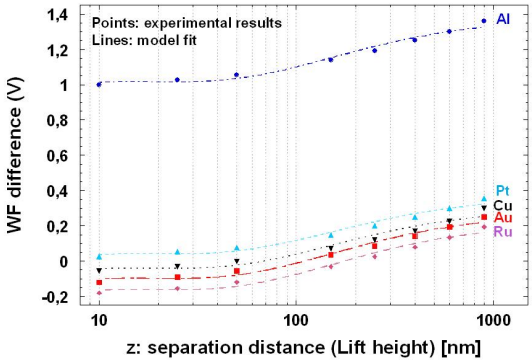

FIGURE 1. Agreement between the model fit and the experimental WF difference changes as a function of the lift height.

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Keywords: KFM, Work function, Lift height dependence